IMPROVING BUS TRANSIT COMMUNICATION TO SAVE LIVES

OCTOBER 31, 2005

DRPT

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OCTOBER 31, 2005

PREPARED FOR THE

VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

BY

HNTB CORPORATION

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EXECUTIVE SUMMARY

Virginia's bus transit providers could be of tremendous value during natural or manmade disasters, getting people out of harm's way and reporting on traffic and weather conditions. But if disaster were to strike Virginia today, the buses, vans, and drivers could not be used to their full potential because of poor communication infrastructure.

Virginia's bus transit agencies report a combined carrying capacity of nearly 150,000 people. Naturally, most of this capacity is in the Commonwealth's large urban areas, but 16 percent of that capacity, enough to carry about 23,000 people in a single trip, is in rural and small urban areas.

Could these buses and vans be put to work during an evacuation? The picture is mixed, but not encouraging.

The bus transit agencies in the area under evacuation could probably respond quickly and effectively, if their usual communication systems were operational. Most transit vehicles in the Commonwealth are equipped with radios, so that a dispatcher could quickly contact the drivers and assign them evacuation duties. Most of the agencies also have emergency response plans that should facilitate rapid mobilization, although only about half the agencies have practiced carrying out the plan.

Transit vehicles from outside the area under evacuation would also be able to mobilize quickly, but they wouldn't be productive in the evacuation area because, in most cases, their radios wouldn't work. Thus, neither the local transit agency's dispatchers nor the emergency management agency would be able to contact the vehicles based outside the area.

Even the local bus fleet would not be put to optimal use if the emergency management agency couldn't communicate with the transit dispatchers. Over one third of the transit agencies report telephone and cell phone as their only means of communication with their local emergency management agency. The public phone systems may fail due to weather damage. If not, they may be overwhelmed by the number of attempted calls. Even if the phone network is operational, the emergency management agency may be unable to handle the number of incoming calls, leaving the transit dispatcher unable to get through.

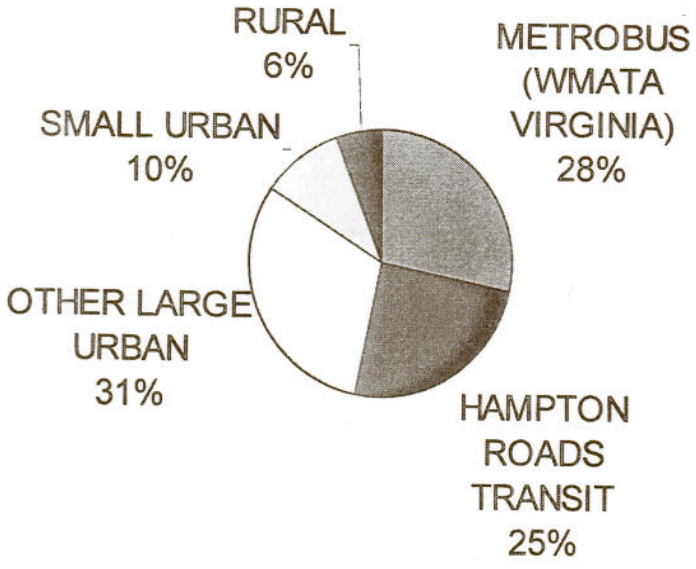
To maximize the number of lives that Virginia's transit agencies can save in the Commonwealth's next disaster, two things should be done. First, steps should be taken to ensure reliable, convenient communication between all bus transit agencies and their local emergency management agencies. This could entail expanding the radio systems used by other emergency response organizations to include the transit dispatchers. Alternatively, transit agency radio systems could be extended to reach the emergency management agency. Second, a method must be developed whereby transit vehicles from one area of the Commonwealth can be used in another area, with reliable radio communication to a local dispatcher. This is partly a matter of buying new radio equipment, but it also entails developing interoperability standards to guide those agencies that buy new radio equipment for other reasons.

WHAT BUS TRANSIT PROVIDERS CAN DO IN A DISASTER

VIRGINIA'S BUS TRANSIT PROVIDERS COULD BE OF TREMENDOUS VALUE DURING NATURAL OR MANMADE DISASTERS, GETTING PEOPLE OUT OF HARM'S WAY AND REPORTING ON TRAFFIC AND WEATHER CONDITIONS.

In response to a survey that HNTB Corporation conducted for this study, Virginia's bus transit providers report a combined carrying capacity of nearly 150,000 people. One hundred percent of the Commonwealth's 36 bus transit providers responded to the questionnaire, although some respondents did not answer every question. The questionnaire is shown in Appendix A. The table on the next page shows the results for the questions pertaining to capacity.

As the graph below shows, two agencies, one in Northern Virginia and the other in Hampton Roads, account for more than half the Commonwealth's bus and van capacity. Those two and the other large urban providers account for 84% of the total capacity. Rural and small urban providers account for the remaining 16 percent of the capacity. Although 16 percent doesn't sound like much, it is enough capacity to carry 24,000 people in a single trip.



WHAT TRANSIT CAN DO CON'T.

CARRYING CAPACITY

TRANSIT PROVIDERS

Public Transportation Systems	Drivers at one time	Vehicles in Fleet	Seated Capacity	Standing Capacity	Overall Capacity
LARGE URBAN SYSTEM					
Alexandria Transit Company (DASH)	38	57	2,109	741	2,850
Arlington Transit (ART)	25	30	688	338	1,026
Fairfax County Connector	145	170	6,056	8,303	14,359
City of Fairfax CUE	9	12	348	180	528
Greater Richmond Transit Company (GRTC)	224	240	7,286	3,720	11,006
Hampton Roads Transit (HRT)	327	565	14,565	22,381	36,946
Loudon County Commuter Service	23	24	1,320	288	1,608
Metrobus (WMATA) - Servicing Virginia	307	372	13,862	28,441	42,303
Petersburg Area Transit	11	14	508	70	578
Potomac & Rappahannock Transp. Comm. (OmniRide, OmniLink)	85	108	5,187	7,585	12,772
Williamsburg Area Transport	18	20	500	1,000	1,500
Subtotal	1,212	1,612	52,429	73,047	125,476
SMALL URBAN SYSTEM					
Blacksburg Transit	24	43	1,244	6,020	7,264
Bristol Virginia Transit	4	5	95	0	95
Charlottesville Transit Service	28	28	750	385	1,135
Danville Mass Transit Service	9	16	378	487	865
Fredericksburg Regional Transit (FRED)	15	21	369	165	534
Greater Lynchburg Transit Company	21	29	775	341	1,116
Greater Roanoke Transit Company (Valley Metro)	31	44	1,812	264	2,076
Harrisonburg Public Transit	25	30	752	1,360	2,112
Winchester Transit	7	12	142	0	142
Subtotal	164	228	6,317	9,022	15,339
RURAL SYSTEM					
Town of Chincoteague	3	3	84	0	84
Bay Transit	17	43	563	0	563
Town of Blackstone	1	4	61	0	61
Bluefield - Graham Transit	3	4	50	0	50
District Three Governmental Cooperative	23	46	724	724	1,448
Farmville Area Bus	6	14	146	99	245
Four County Transit (AASC)	34	53	771	10	781
Greene County Transit	7	13	175	0	175
JAUNT, Inc.	55	68	1,208	0	1,208
Town of Kenbridge	1	2	30	0	30
Lake Area Bus	1	2	24	0	24
Mountain Empire Older Citizens, Inc.	20	37	647	585	1,232
Pulaski Area Transit	3	4	48	100	148
RADAR (Unified Human Transportation Services, Inc.)	50	60	787	0	787
STAR Transit	5	11	158	0	158
Virginia Regional Transportation Association	63	59	1,086	272	1,358
Subtotal	292	423	6,562	1,790	8,352
TOTAL, ALL PROVIDERS	1,668	2,263	65,308	83,859	149,167

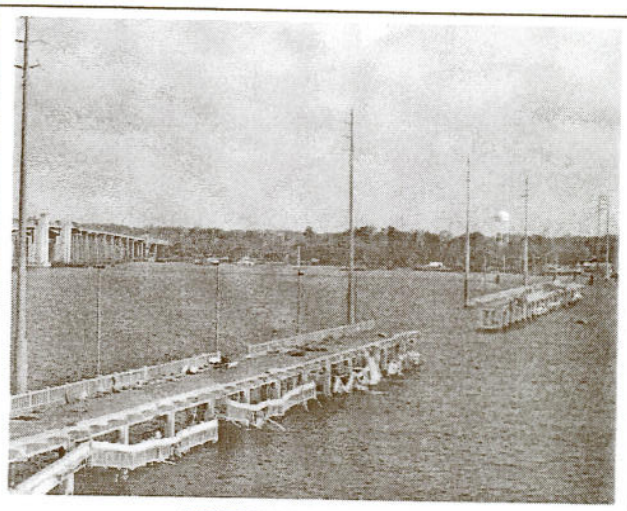
WHAT TRANSIT CAN DO CON'T.

With over 2,200 buses and vans at their disposal, bus transit providers can save the lives of people who would otherwise be unable to evacuate during a hurricane, dirty bomb attack, or similar disaster. After the event, they can transport rescued people to shelters. Recently, people living along the Gulf Coast died because they were unable to drive themselves out of the path of Hurricane Katrina. Those unfortunate victims were mostly too poor, too sick, or too infirm to transport themselves. In the Gulf states, bus transit providers saved many such people, but were hampered by gridlock and communication breakdowns, among other factors.

No one familiar with the devastation that Katrina brought can doubt that Virginia's coastal areas – both urban Tidewater and the rural Eastern Shore – could suffer horribly as a result of a major hurricane. Clearly, evacuating the Hampton Roads area could use every bus and van that Virginia's transit operators and school systems could possibly provide.

The need for evacuation resources in Virginia's rural interior may be less obvious, except to Virginians who experienced Hurricane Camille in 1969. The prolonged, torrential rains brought by Camille subjected about one-fifth of the state to flooding and landslides. The James River flooded Richmond, putting downtown under about six feet of water. The worst damage was in rural, hilly Nelson County, where 27 inches of rain fell in 12 hours and about one percent of the population was killed. In all, Virginia lost 153 people, its worst natural disaster ever.

Camille's floods also destroyed 113 bridges and many miles of road. Katrina's destruction of roads and bridges included I-10, a major evacuation route out of New Orleans. Such road and bridge destruction slows emergency responders as well as evacuees. Who better to report the location of flooding, landslides, bridge failures, and blocked lanes than radio-equipped bus drivers? In the course of aiding an evacuation, bus transit providers can provide the emergency managers with a steady flow of information about conditions in the field.

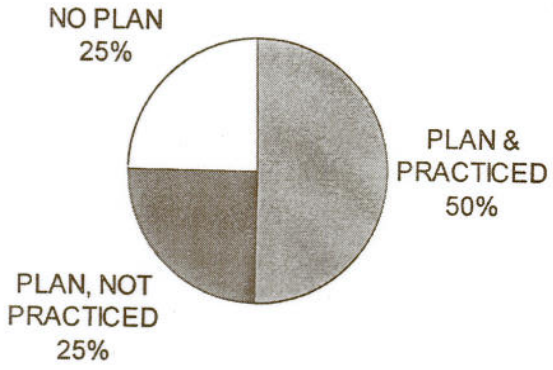


A BRIDGE IN BILOXI AFTER KATRINA

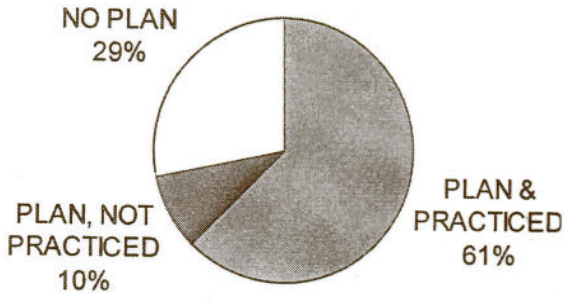
Especially in rural areas, bus transit providers have another contribution to make: they know who the transit-dependent people are, where they live, and whether they need wheelchair lifts. After years of providing transportation to the elderly and handicapped, drivers can quickly go to the homes of their regular customers and give them a life-saving ride. The familiar face of a trusted driver could also be the factor that persuades an elderly person to leave home.

As will be discussed in the next section, Virginia's bus transit providers are not fully prepared to effectively assist in a disaster. However, 75 percent of survey respondents say they have prepared emergency response plans and 50 percent say they have conducted drills to test the plans and rehearse for emergencies.

WHAT TRANSIT CAN DO CON'T.



PORTION OF AGENCIES



PORTION OF CAPACITY

The providers with no emergency response plan account for 29 percent of the respondents' carrying capacity. That is because massive Hampton Roads Transit has not finished developing its plan. When Hampton Roads Transit finishes and rehearses its plan, about 90 percent of Virginia's bus transit capacity will belong to providers that have planned and rehearsed their emergency responses.

The table on the next page shows the status of emergency planning for individual providers.

WHAT TRANSIT CAN DO CON'T.

EMERGENCY PLANNING

TRANSIT PROVIDERS

Public Transportation Systems	Overall Capacity	Emergency Response Plan	Plan Practiced
LARGE URBAN SYSTEM			
Alexandria Transit Company (DASH)	2,850	No	N/A
Arlington Transit (ART)	1,026	Yes	Yes
Fairfax County Connector	14,359	Yes	Yes
City of Fairfax CUE	528	Yes	Yes
Greater Richmond Transit Company (GRTC)	11,006	Yes	Yes
Hampton Roads Transit (HRT)	36,946	In works	N/A
Loudon County Commuter Service	1,608	Yes	No
Metrobus (WMATA) - Servicing Virginia	42,303	Yes	Yes
Petersburg Area Transit	578	Yes	Yes
Potomac & Rappahannock Transp. Comm. (OmniRide, OmniLink)	12,772	Yes	Yes
Williamsburg Area Transport	1,500	Yes	Yes
Subtotal	125,476	9/11	8/9
SMALL URBAN SYSTEM			
Blacksburg Transit	7,264	Yes	No
Bristol Virginia Transit	95	City does	No
Charlottesville Transit Service	1,135	Yes	Yes
Danville Mass Transit Service	865	Yes	No
Fredericksburg Regional Transit (FRED)	534	Part of one	No
Greater Lynchburg Transit Company	1,116	No	
Greater Roanoke Transit Company (Valley Metro)	2,076	Yes	Yes
Harrisonburg Public Transit	2,112	City does	Yes
Winchester Transit	142	Yes, not formal	Yes
Subtotal	15,339	8/9	4/8
RURAL SYSTEM			
Town of Chincoteague	84	Yes	Yes
Bay Transit	563	No	N/A
Town of Blackstone	61	No	N/A
Bluefield - Graham Transit	50	No	N/A
District Three Governmental Cooperative	1,448	Yes	Yes
Farmville Area Bus	245	Yes	Yes
Four County Transit (AASC)	781	Yes	Yes
Greene County Transit	175	Yes	Yes
JAUNT, Inc.	1,208	Yes	No
Town of Kenbridge	30	No	N/A
Lake Area Bus	24	Yes	No
Mountain Empire Older Citizens, Inc.	1,232	Yes	No
Pulaski Area Transit	148	Yes	Yes
RADAR (Unified Human Transportation Services, Inc.)	787	No	N/A
STAR Transit	158	No	N/A
Virginia Regional Transportation Association	1,358	Yes	No
Subtotal	8,352	10/16	6/10
TOTAL, ALL PROVIDERS	149,167	27/36	18/27

TRANSIT PROVIDERS' COMMUNICATION CAPABILITIES

COMMUNICATION PROBLEMS WILL HAMPER TRANSIT PROVIDERS' EFFORTS TO SAVE LIVES IN A DISASTER.

Successful use of transit assets in emergency response requires more than buses, vans, drivers, plans, and a desire to help. It also requires, among other things, communication between the drivers on the road and a central manager who monitors conditions, assigns duties, and coordinates the various emergency response activities. This communication channel is formed by two links: driver-dispatcher and dispatcher-emergency manager. Each of these links is discussed below.

2.A DRIVER-DISPATCHER COMMUNICATION

The survey showed that just four responding providers, Arlington County Transit, Loudon County Commuter Service, Pulaski Area Transit, and the Town of Kenbridge, do not have radio systems linking their buses with a central location. Together, the four account for only two percent of the respondents' capacity. Three of the four use Nextel's service to link their drivers to dispatchers. Using their own radio systems or Nextel service, dispatchers can normally contact drivers quickly to respond to an emergency, and drivers can immediately report unexpected conditions they encounter. The providers report that their radio systems normally work well, except for dead zones caused by hills and buildings blocking the radio signals.

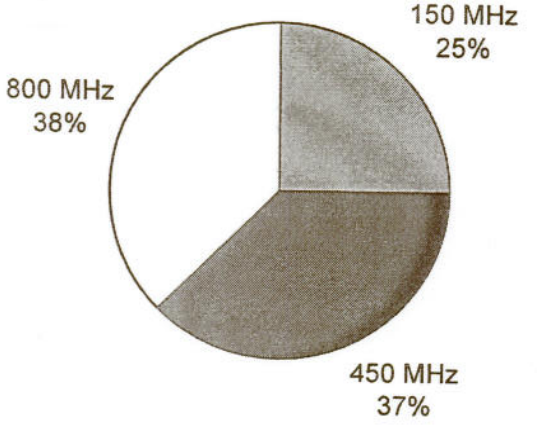
Although reliable in normal situations, these communication links are vulnerable during certain types of disasters.

- For the providers dependent on Nextel service, large disasters are likely to generate so much cell phone traffic that most calls will not go through.
- Both cell phone towers and provider-owned radio antennae are vulnerable to the fierce winds of tornados and hurricanes.
- The power outages that accompany most natural disasters can knock out a radio system. Several respondents including the Greater Richmond Transit Company expressed a desire to acquire generators so as to have communication during prolonged power outages.
- Flooding can also cut communication to the buses by submerging the dispatch location. That happened to the offices of New Orleans Regional Transit Authority during Hurricane Katrina.

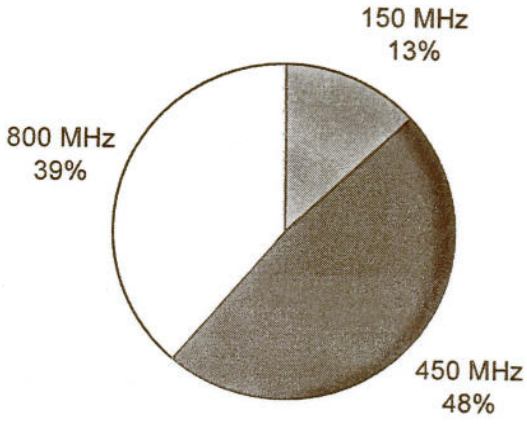
COMMUNICATION CAPABILITIES CON'T.

When their radio systems fail, most providers use cell phones as a backup. This is problematic in areas where cell phone coverage is spotty. In times of disaster, cell phone service may be unavailable for the reasons noted above.

Despite these considerations, the fact that nearly all of Virginia's transit vehicles are radio-equipped is the bright spot in the emergency response picture. The bad news is that the radios generally become useless when a transit vehicle leaves its home area to aid in an evacuation elsewhere. Interoperability with other transit systems has rarely been a consideration when a provider acquires radio equipment. The result is a mix of incompatible systems spread over three frequency bands.



PORTION OF AGENCIES



PORTION OF VEHICLES

As the graph on the left shows, the respondents are about equally divided among the three frequency bands commonly used for transit: 150 MHz (also called VHF); 450 MHz (also called UHF); and 800 MHz. When provider size is taken into account, the picture changes. The majority of the radios in Virginia transit vehicles use the 450 MHz band, as the graph on the right shows. This may change in the future; several of the providers using the other two bands expressed a desire or plan to move to an 800 MHz system. Petersburg Area Transit, for example, is now in the process of replacing its 450 MHz system with an 800 MHz system.

The table on the next page summarizes the information each respondent provided about its radio system. Most Virginia providers use Motorola radios. However, radios are not interoperable just because they are from the same manufacturer and use the same frequency band. In general, radios in one provider's vehicles cannot communicate with another provider's dispatcher.

COMMUNICATION CAPABILITIES CON'T.

RADIO SYSTEM CAPABILITIES

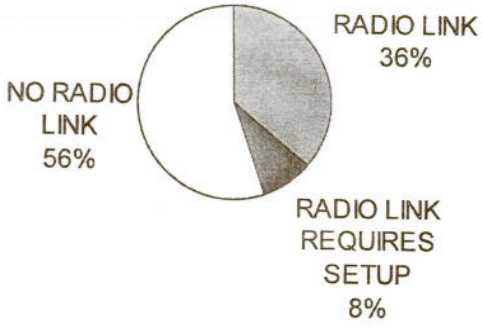
TRANSIT PROVIDERS

Public Transportation Systems	Vehicles in Fleet	Radio	150 MHz	450 MHz	800 MHz
LARGE URBAN SYSTEM					
Alexandria Transit Company (DASH)	57	Motorola			
Arlington Transit (ART)	30	N/A			
Fairfax County Connector	170	Motorola (800 MHz)			X
City of Fairfax CUE	12	Motorola			
Greater Richmond Transit Company (GRTC)	240	Motorola (452 MHz), Maxtrac (800MHz)		X	
Hampton Roads Transit (HRT)	565	Motorola & Ericsson			
Loudon County Commuter Service	24	N/A			
Metrobus (WMATA) - Servicing Virginia	372	on bus, support vehicles			
Petersburg Area Transit	14	Motorola (UHF)			X
Potomac & Rappahannock Transp. Comm. (OmniRide, OmniLink)	108	Nextel, GreyHawk			X
Williamsburg Area Transport	20	Motorola base, mobile (800)			X
Subtotal	1,612				
SMALL URBAN SYSTEM					
Blacksburg Transit	43	Motorola (460, 453 MHz)		X	
Bristol Virginia Transit	5	GE (458), Motorola (458)		X	
Charlottesville Transit Service	28	Motorola	X		
Danville Mass Transit Service	16	Kenwood base, mobile, hand held			
Fredericksburg Regional Transit (FRED)	21	Motorola	X		
Greater Lynchburg Transit Company	29	Motorola base, portable			
Greater Roanoke Transit Company (Valley Metro)	44	800 MHz trunk system			X
Harrisonburg Public Transit	30	Motorola DeskTrac	X		
Winchester Transit	12	Motorola			
Subtotal	228				
RURAL SYSTEM					
Town of Chincoteague	3	Motorola			
Bay Transit	43	Motorola (150)	X		
Town of Blackstone	4	Commtronics			
Bluefield - Graham Transit	4	Motorola			
District Three Governmental Cooperative	46	Motorola, Radium, Radius			
Farmville Area Bus	14	Motorola			
Four County Transit (AASC)	53	Motorola (464)		X	
Greene County Transit	13	Maxon hand held, Kenwood bus units			
JAUNT, Inc.	68	Motorola		X	
Town of Kenbridge	2	N/A			
Lake Area Bus	2	Uniden			
Mountain Empire Older Citizens, Inc.	37	Motorola amplifier, handhelds		X	
Pulaski Area Transit	4	N/A			X
RADAR (Unified Human Transportation Services, Inc.)	60	X			
STAR Transit	11	Motorola base, handhelds			
Virginia Regional Transportation Association	59	Kenwood			
Subtotal	423				
TOTAL, ALL PROVIDERS	2,263		4	6	6

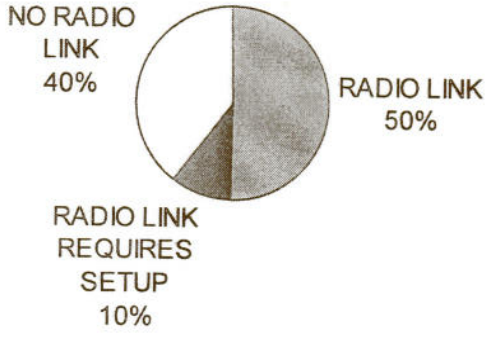
2.B DISPATCHER-EMERGENCY MANAGER COMMUNICATION

Providers representing sixty percent of the survey respondents' capacity have a radio link to some emergency response agency, but the rest rely on telephone. As noted earlier, telephone service is vulnerable to overloading and weather-related failures during disasters. Although reliance on telephone communication is most common among small bus transit providers, Hampton Roads Transit, a very large operation, also reported no radio link to the emergency response agency for its area.

Not all the radio links are continuously operational. Some, like the one used by Winchester Transit, are always active but are monitored only when the emergency response dispatcher has been asked to listen to the transit provider's radio channel. Thus, the bus transit provider must first make telephone contact before the radio link is of any value. OmniRide has a different situation. The transit dispatcher has a radio that is compatible with those used by the emergency response agencies, but is unable to communicate with those agencies until a technician reprograms the radio system to establish a common channel for transit and emergency response.



PORTION OF PROVIDERS



PORTION OF CAPACITY

The table on the next page shows which respondents have radio links between their dispatcher and their local emergency response agency. An asterisk denotes a radio link that requires some sort of notification or setup before it is operational.

COMMUNICATION CAPABILITIES CON'T.

RADIO LINKS TO EMERGENCY RESPONSE AGENCY

TRANSIT PROVIDERS

Public Transportation Systems	Overall Capacity	Dispatcher-Emergency Response Radio Link?
LARGE URBAN SYSTEM		
Alexandria Transit Company (DASH)	2,850	Y
Arlington Transit (ART)	1,026	N
Fairfax County Connector	14,359	Y
City of Fairfax CUE	528	N
Greater Richmond Transit Company (GRTC)	11,006	Y
Hampton Roads Transit (HRT)	36,946	N
Loudon County Commuter Service	1,608	N
Metrobus (WMATA) - Servicing Virginia	42,303	Y
Petersburg Area Transit	578	Y
Potomac & Rappahannock Transp. Comm. (OmniRide, OmniLink)	12,772	Y*
Williamsburg Area Transport	1,500	Y
Subtotal	125,476	
SMALL URBAN SYSTEM		
Blacksburg Transit	7,264	N
Bristol Virginia Transit	95	N
Charlottesville Transit Service	1,135	N
Danville Mass Transit Service	865	Y*
Fredericksburg Regional Transit (FRED)	534	Y
Greater Lynchburg Transit Company	1,116	N
Greater Roanoke Transit Company (Valley Metro)	2,076	Y*
Harrisonburg Public Transit	2,112	N
Winchester Transit	142	Y*
Subtotal	15,339	
RURAL SYSTEM		
Town of Chincoteague	84	Y
Bay Transit	563	N
Town of Blackstone	61	Y
Bluefield - Graham Transit	50	Y
District Three Governmental Cooperative	1,448	N
Farmville Area Bus	245	Y
Four County Transit (AASC)	781	N
Greene County Transit	175	Y
JAUNT, Inc.	1,208	N
Town of Kenbridge	30	N
Lake Area Bus	24	N
Mountain Empire Older Citizens, Inc.	1,232	N
Pulaski Area Transit	148	N
RADAR (Unified Human Transportation Services, Inc.)	787	N
STAR Transit	158	N
Virginia Regional Transportation Association	1,358	N
Subtotal	8,352	
TOTAL, ALL PROVIDERS	149,167	

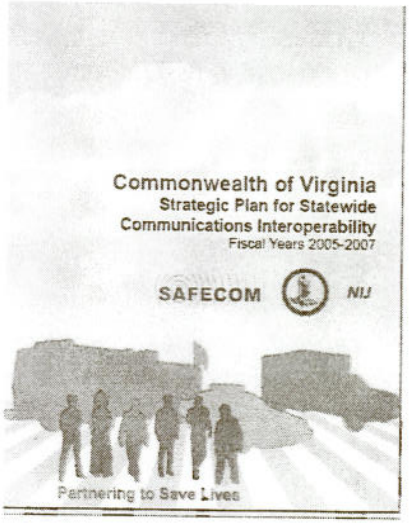
IMPROVING COMMUNICATION TO IMPROVE DISASTER RESPONSE

BUS TRANSIT PROVIDERS SHOULD MAKE THE SAME KINDS OF IMPROVEMENTS THAT OTHER EMERGENCY RESPONSE ORGANIZATIONS ARE MAKING.

All disaster response agencies have problems achieving reliable communication between a central management location and workers in the field, particularly when people and equipment are brought in from outside the area. The solutions to these problems are also largely common to all agencies.

In Virginia, the Governor has set up a State Interoperability Executive Committee and a Commonwealth Interoperability Coordinator's Office to improve communication among public safety organizations. One of the Coordinator's first activities was to prepare a strategic plan that describes the current situation this way:

The lack of interoperable wireless communications systems has been an issue plaguing public safety organizations for decades. In many cases, these organizations do not have adequate radio spectrum (channels or frequencies) or equipment to perform their critical duties. They are unable to communicate or share critical voice and data information with other jurisdictions or disciplines in day-to-day operations or during major emergency response scenarios, including natural disasters and terrorist acts.



In the Commonwealth, the majority of local public safety responders are not able to communicate effectively or directly with their state-level counterparts. Additionally, communication between local, regional, and state public safety organizations and federal responding agencies is often limited to the telephone. Given the local and regional vulnerabilities and challenges – including terrain, presence of military bases and international airports, natural events (such as hurricanes, tornadoes, etc.), and proximity to Washington D.C. – the inability to relay incident scene information directly, efficiently, or effectively jeopardizes the lives of the Commonwealth's public safety responders and citizens.

The Commonwealth recognizes the critical need to improve communications interoperability between and among jurisdictions and disciplines to enhance the safety and security of public safety responders and citizens throughout the Commonwealth.[1]

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[1] Commonwealth Interoperability Coordinator's Office, *Commonwealth of Virginia Strategic Plan for Statewide Communications Interoperability,* www.interoperability.publicsafety.virginia.gov/StratPlan/2006InteroperabilityStrat%20Plan.pdf, 2004, p.5.

Although the above statement is perfectly applicable to Virginia's bus transit providers, the 63-page plan never mentions transit. Its focus is on "first responders" – police, fire, and emergency medical services. Although the need to provide radio interoperability among transit systems may be obvious to those in the transit business, it is apparently not a top priority for the emergency management executives. It would likely be to everyone's benefit if the transit community got more involved in the meetings, focus groups, and conferences pertaining to interoperability, such as the 2005 Virginia Interoperable Communications Conference that was held in Virginia Beach on October 4 and 5, 2005. Such participation could include raising the awareness of emergency management executives and planners about the contribution that transit can make in evacuations and rescue operations. It would also serve to familiarize those in the transit community with the technologies and standards that other emergency response agencies are using to achieve interoperability and to improve reliability. Perhaps VDRPT and the Community Transportation Association of Virginia (CTAV) could spearhead this participation.

It isn't just in Virginia that bus transit is in danger of being overlooked. In 2004, the U.S. Department of Homeland Security (DHS) published *Statement of Requirements for Public Safety Wireless Communications & Interoperability.* It is a very detailed, 174-page description of how the communication system of the near future is supposed to work. The book includes detailed scenarios of emergency situations, describing what each agency does and how they communicate at every step of a mission. The communication needs of transit providers are not discussed in the report, yet in the discussion of a hypothetical hurricane, it becomes apparent that the authors presume that every transit bus and school bus will have a radio that complies with the functional specifications proposed elsewhere in their report: "City public buses and public school buses, both of whom operate on the public safety trunked radio system, are alerted and organized to support transport of victims and the public to treatment facilities or shelters."[2]

Because other public safety and emergency response agencies are tackling the same communication problems that bus transit providers face, those agencies are a source of ideas that may be applicable to transit. The remainder of this chapter summarizes the trends in communication among emergency response agencies, including technologies and policies that bus transit providers should consider.

3.A INTEROPERABLE RADIOS

Some agencies are switching to new radios that meet the "Project 25" standard for interoperability. The standard is the result of work by the Association of Public Safety Communications Officers (APCO) Project 25 committee. The coalition of companies and agencies promoting this standard has established a web site (http://www.project25.org) that describes the standard as follows:

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[2] Department of Homeland Security, *Statement of Requirements for Public Safety Wireless Communications & Interoperability,* http://www.safecomprogram.gov/NR/rdonlyres/A1118073-1B21-42DC-941F-C9DB26F4DBEF/0/PSCI_Statement_of_Requirements_v1_0.pdf, 2004, p. 160.

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Project 25 (P25) is the standard for interoperable digital two-way wireless communications products and systems. Developed under state, local and federal government guidance and Telecommunications Industry Association (TIA) governance, P25 is gaining worldwide acceptance for public safety, security, public service, and commercial applications. The published P25 standards suite is administered by the TIA in their Mobile and Personal Private Radio Standards Committee (TR-8). Equipment that demonstrates compliance with P25 is able to meet a set of minimum requirements to fit the needs of public safety. These include the ability to interoperate with other P25 equipment, for example so that users on different systems can talk via direct radio contact.

Can the P25 radios really solve the problem of interoperability? DHS is a believer. DHS grants for emergency communication systems require that new systems be P25-compliant. Because of disappointing performance by some radios certified as P25-compliant by their manufacturers, DHS has arranged for the National Institute of Standards and Technology to develop testing standards for P25 radios and to oversee a certification program for P25 radios.

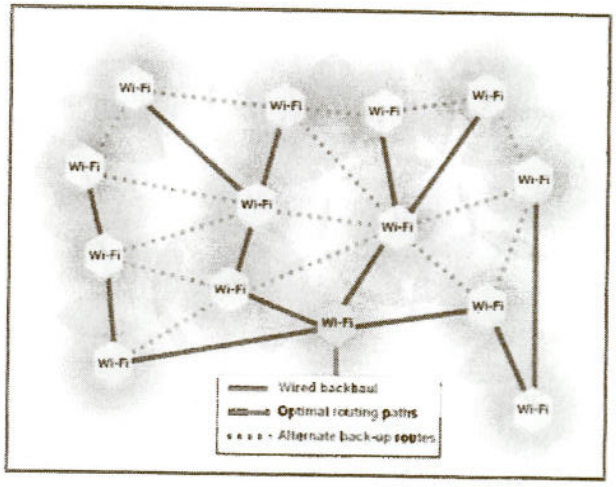
Bus transit providers contemplating new radio systems should become familiar with the Project 25 standard and consider whether it is a good fit for their organization. If widely adopted, as seems likely, a bus transit provider with P25 radios should be able to communicate more easily with other emergency response agencies in his home area, and also with drivers in buses brought in from other areas.

3.B MULTIPLE BASE STATION SITES

New land mobile radio systems sometimes resemble cellular telephone systems more than they resemble older radio systems. Instead of a single antenna covering a large territory, they often have numerous antennae, each covering a small portion of the service area. This design increases cost and complexity, but reduces dead zones. It also reduces the chance that damage to a single central antenna or base station will entirely shut down the radio system.

3.C MESH NETWORKS

Some land mobile radio systems with multiple base stations are called "mesh" networks. In a mesh network, each base station not only links mobile radios to a dispatch center, but also can serve as a repeater, linking other base stations to the dispatch center. A base station communicates with all the surrounding base stations and can detect the failure of a neighboring base station. When a base station fails, the remaining base stations automatically find a new path for the data that previously went



through the damaged base station. The failure of a base station creates a dead zone in the vicinity of the failed base station, but leaves the rest of the network operational.

3.D SHARED NETWORKS

Until recently, most transit providers, like police departments, fire departments, and other fleets, have operated independent radio systems. Sharing resources meant one organization allowed another to mount an antenna on its tower. Now, municipalities and states are establishing shared communication networks that are highly integrated; the same base stations and data channels serve multiple users, much as the local area network and printers in a modern office are shared. The rationale is that when the costs and assets are shared, all users benefit from improved coverage, greater reliability, and lower costs.

Sharing, of course, entails risks. The main concern that a transit provider might have about joining a shared system is loss of control. If the service is not as good as promised or the costs billed to the provider are higher than predicted, the transit provider might regret giving up his independent system. Another consideration is that even a fraction of the cost of a sophisticated radio system with excellent coverage and reliability could exceed the entire cost of a simple system.

A perfect example of a shared network is Virginia's new STARS system. Here's what the Commonwealth's web site says about the system, which is now under construction:

The STARS Program was originally conceived in the mid nineteen-nineties to be an upgrade to the antiquated Virginia State Police land mobile radio system, which was implemented in 1977. As planning progressed, both technology advances and direction from state government led the program to the present concept of a shared system composed of the twenty state agencies that use two-way radio communication as a regular part of their operations.

To support the large increase of user agencies and radios, the microwave backbone of the system is undergoing a complete renovation. The 87 existing tower sites will grow to 121 sites and the network is now designed to have alternate paths, or rings, to provide continuously high reliability in the event of path outage. Forty-five of these tower sites will be used for two-way communications with user radios. These sites will provide Commonwealth personnel quality, statewide, mobile radio coverage.[3]

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[3] http://www.interoperability.publicsafety.virginia.gov/CommSys/STARS.cfm

3.E SECURE DISPATCH CENTERS

To ensure that they remain operational during a disaster, some public safety agencies have established emergency operations centers that have backup power and provision for staff to sleep, eat, and shower there during emergencies lasting several days. Often, such locations have been selected to ensure that the building and the approach roadways are not in danger of flood damage. Sometimes the centers have satellite telephones, allowing the agency to coordinate its activities with other emergency response agencies in different locations.

WMATA is taking the secure dispatch center concept one step further; it plans a backup Operations Command Center that could keep Metrobus and Metrorail operating even if WMATA's primary command center is unusable.

3.F JOINT EMERGENCY OPERATIONS CENTERS

Many jurisdictions have established joint emergency operations centers (EOCs). The leaders of most of the emergency response agencies work there during disasters in order to be in close proximity to one another. One reason for this is the improved coordination that presumably results when people from different agencies are in constant face-to-face contact and all have access to the same information. Another benefit is economy; a single facility with backup power, elaborate communication systems, and facilities for sleeping and eating is surely less costly than separate facilities for each agency.

In the case of bus transit providers, dispatching from a joint EOC during a disaster could be a cost-effective alternative to building a new, secure dispatch center or even to upgrading an existing dispatch center. However, there could be a substantial cost for radio equipment that would permit the joint EOC to function as the transit dispatch center. Participation in a shared communication system might slash that cost, as a joint EOC would already be tied in to that communication system.

3.G NEXT STEPS

There are four kinds of work that will promote effective participation by bus transit providers in evacuation and rescue situations. First is the task of developing a consensus on what bus transit providers should do in a disaster. Some providers may find the concept of mutual aid among transit systems unfamiliar and uncomfortable. There will be questions about the chain of command, reimbursement for expenses, and liability for abandoning service at home in order to help out in another community. These should be worked out in advance. Once a consensus develops on the big picture issues, additional work is needed to reach agreement on the need for interoperable radios, robust communication systems, and secure dispatch centers. Both VDRPT and CTAV could be key players in developing this shared vision. Note that the vision should be shared not only by the transit community but also by the emergency response agencies with which the transit community wants to collaborate.

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The second area of work is technical, the evaluation of standards and policies that facilitate transit communication during emergencies. Should VDRPT and CTAV recommend that all bus transit providers transition to Project 25-compliant radios? Should VDRPT follow DHS's lead and refuse to fund new radio systems that are not P25 compliant? Should VDRPT and CTAV encourage bus transit providers to move to a common frequency band? If so, which one? Should VDRPT fund projects to improve the security of dispatch centers and refuse to fund transit facilities that do not have certain features like generators?

The third area of work is educational, acquainting providers with the technologies and standards that are recommended by the technical evaluations proposed in the previous paragraph. The educational program should also acquaint providers with the experiences of bus transit providers who have participated in evacuations or who have used the recommended technologies. What features of a dispatch center helped keep it functioning during a disaster? Have P25 radios lived up to their promise? Would a provider who uses a multi-agency communication system go back to an independent system if he could? CTAV meetings would be excellent venues for presentations on these topics.

The final area of work is speeding the pace of communication improvements by funding them. The Commonwealth's legislature is the major player in accomplishing this, although the Governor's office may be in a position to direct some Federal DHS funding to the problem.

It will take a lot of work to significantly improve the capability of transit providers to assist in evacuations and large scale rescue efforts. The recent events along the Gulf Coast, as well as previous events within the Commonwealth, highlight the need for the steps that have been recommended in this report.

APPENDIX A: SURVEY QUESTIONNAIRE

Department of Rail and Public Transportation
Transit Communications Questionnaire

Thank you for taking time to fill out this questionnaire. This should aid in generating interest and funds to ensure that your agency's capabilities can be used to its best advantage during an emergency. Please fill this out and mail back to:

Mike Packard
HNTB Corporation
2900 South Quincy St.
Suite 200
Arlington, VA 22206

Phone: (703) 824-5100

TRANSIT COMMUNICATIONS QUESTIONNAIRE

Name and position of person(s) completing questionnaire: _____

Agency name: _____

Phone number: _____

Address: _____

Areas Serviced: _____

Drivers on duty at any one time: _____

Number of vehicles in fleet: _____

FLEET SUMMARY			
TYPE OF VEHICLE	NUMBER IN FLEET	CAPACITY	
		SEATED	STANDING

COMMUNICATION SYSTEMS

TYPE OF SYSTEM	BRAND AND MODEL	NUMBER OF UNITS	FREQUENCY	FUNCTIONS (Mark 'X' for all that apply)						
				Bus to Bus	Bus to Dispatcher	Dispatcher to One Bus	Broadcast to Fleet	Dispatcher to Emergency Response	Emergency Response to Dispatcher	Bus to Emergency Response
Wired telephone										
Cellular telephone										
Radio System #1 (Describe)										
Radio System #2 (Describe)										
Radio System #3 (Describe)										
Radio System #4 (Describe)										

Department of Rail and Public Transportation
Transit Communications Questionnaire

1. What do you find to be the limitations, if any, of each of the systems?

2. Do you have plans to implement new technology in the near future? If so, what type and for what purposes? What, if any, existing system will this replace?

3. Describe the set-up of your operations center, including equipment available and ability to access and relay information quickly.

4. What is your primary means of communication in a time of emergency?

5. Which emergency response agencies do you report incidents to (fire and rescue, local law enforcement, state police, sheriffs, emergency medical services, hospitals, local government, National Guard)?

6. Do you currently have an emergency response plan in place?

7. If so, has this plan been tested as well as practiced with the current staff?

8. What improvements would you most like to make to your existing communications systems? What benefit would these improvements have to your emergency response capabilities?

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